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| 10/652,269 | 08/28/2003 | Yan Zhou | 10095/18 | 1981 |
| 757 | 7590 | 11/30/2005 | EXAMINER | |
| BRINKS HOFER GILSON & LIONE | | | CHIEM, DINH D | |
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| CHICAGO, IL 60610 | | | PAPER NUMBER | |
| | | | 2883 | |

DATE MAILED: 11/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/652,269

Applicant(s)

ZHOU ET AL.

Examiner

Erin D. Chiem

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,10-20,22-36 and 38-42 is/are pending in the application.
- 4a) Of the above claim(s) 37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,10-20,22-36 and 38-42 is/are rejected.
- 7) ☒ Claim(s) 1,10,23-27 and 39-42 is/are objected to.
- 8) ☒ Claim(s) 37 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 September 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This office action is in response to the amendment filed on September 2, 2005. Currently, claims 1, 4, 10-20, 22-36, and 38-42 are pending and claim 37 is withdrawn from consideration since it is drawn to a non-elected species.

Response to Arguments

Applicant's arguments filed September 2, 2005, with respect to the rejection(s) of claim(s) 1, 10, and 28 under 102(b) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Noijiri et al. and Rogers, Jr. et al.

Drawings

The drawings were received on September 2, 2005. These drawings are not acceptable. In the telephone interview on August 24, 2005, the Examiner suggested to the Applicant as to how the Applicant can place the replacement drawings in acceptable condition. The Examiner suggested removing the unclear graphics printed directly from analytical software such as Fig. 6 and Fig. 7 (a-b) and elaborate on the structural details of Fig. 8 (a-d). The Applicant failed to submit replacement drawings following the Examiner's suggestions and resubmitted the same drawings. Currently there are three same sets of drawings having various levels of clarity. The Applicant did not overcome the drawing objections therefore the Examiner reasserts the objection.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the embodiment wherein the discrete structures include grains having a size in three dimensions that is substantially smaller than an effective wavelength of the light in the second material must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the structural details of a mode transformer and demonstrate through the drawings how the results of Fig. 4A, 4B, and 5 is achieved must be shown or the feature(s) canceled from the claim(s). This feature pertains to claims 23-27 and 39-42. Since the MPEP requires clear and concise disclosure of the invention, the resultant graphics from the analytical software is not sufficient in meeting the MPEP disclosure requirements. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet"

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pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Perhaps the details are shown, but due to the poor resolution of the drawings, the Examiner is uncertain whether the poor resolution is representative of the discrete structures or simple a result of poorly scanned/faxed drawings. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 1 and 10 are objected to because of the following informalities: the recitation "wherein the first material has a first index of refraction and the second material has a second

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index of refraction different from the first index of refraction by at least 0.5" is unclear whether the difference is by *half* (a common notation of half of 1) or the difference being $\Delta n=0.5$.

Appropriate correction is required. For the purpose of examination, the Examiner shall interpret the recitation as being the latter.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4, 10-20, 22, 28-36, and 38 rejected under 35 U.S.C. 103(a) as being unpatentable over Nojiri (US Patent 4,640,585 Nojiri hereinafter) in view of Rogers, Jr. et al. (US Patent 4,859,492 Rogers herein forth).

Regarding claims independent claims 1, 10, and 28 Nojiri teaches a light transmitting device having a graded index of refraction comprising a body (11) made of a first material, GaAs (Fig. 2A); the body having embedded therein a plurality of discrete structures (10), the Examiner interpret the discrete structures as the various layers deposited onto the body, comprising a second material, $\text{Ga}_{0.7}\text{Al}_{0.3}\text{As}$ (13), each of the discrete structures having a size in at least one dimension substantially smaller than an effective wavelength of the light in the second material (col. 2, lines 65-68); wherein the first material has a first index of refraction and the second material has a second index of refraction different from the first index of refraction by at least 0.2 (Table 1), and wherein the size of the discrete structures in the at least one dimension is different

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in a first local region of the body than in a second local region of the body, thereby providing a graded index of refraction. The Examiner respectfully point out to the Applicant that this is the fundamental concept of creating a gradient in refractive index of the optical component, by gradually varying the thickness of the alternating high and low refractive index layers (col. 4, lines 42-47). Furthermore, the graded effective index of refraction along a direction transverse to the layers (col. 3, lines 30-32; Fig. 2A – 3B). As evident in col. 4, lines 42-47 the effect index of refraction in the local region depends on the ratio of the volume of the layers of the first material and the second material. Furthermore, glass and metallic glass are species of amorphous material.

However, Nojiri's teaching uses GaAs/GaAlAs combination as alternating layers and in this combination the refractive index difference is less than $n = 0.5$. Nojiri generically teaches using two different material in which one has a lower refractive index than then other, but does not explicitly teaches using the combinations of SiO_2 and TaO or SiO_2 and TiO_2 .

Rogers teaches a process for forming graded index optical elements (Abstract and col. 4, lines 22-27). For low refractive index material, Rogers uses silicon dioxide ($n = 1.45$) and titanium dioxide ($n = 2.4$) or the titanium dioxide is replaceable with tantalum pentoxide ($n = 2.0$ - 2.5). In both combinations the difference of refractive index is at least $\Delta n = 0.5$ (col. 5, lines 14-19, 21, and col. 6, lines 3-5). Silicon dioxide may be replaceable with other silicon such as disilane and silane (col. 5, lines 49-50) and most commonly used metal and ceramics in semiconductor wafers production are polycrystalline, which have grain boundary thus, contains microscopic crystalline grains. Rogers teaches 4 main purposes for using silicon dioxide as the first material, as follows:

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1. Provide the low refractive index as required to form the final structure
2. Stoichiometric oxides are chemically stable
3. Transmissive to the wavelengths of radiation used in photochemical reaction
4. Transmissive to the wavelengths of radiation used in the final optical structure

And titanium dioxide and tantalum dioxide are chosen as the second material for their high refractive index quality, and vapor deposition stability.

Since Nojiri and Rogers are both from the same field of endeavor, the purpose disclosed by Rogers would have been recognized in the pertinent art of Nojiri.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to apply the vapor deposition method of making graded index optical elements with the specific suggested compounds as taught by Rogers to modify the product as taught by Nojiri to achieve the product as claimed by the Applicant. **The motivation** for modifying Nojiri's teaching with Rogers teaching is for environmental stability toward moisture thus avoids degradation by moisture.

Regarding claims 14 and 32 the Examiner has determined that these three claims are presented in product-by-process structure. The product is the light transmitting device and the process is the controlling step to maintain:

- The thickness of each layer within 0.5 nm (claims 14, 32)
- The effective index of refraction within 0.005 (claims 14, 32)

Thus, the Examiner determined that the limitations of these two claims has been met by Nojiri in view of Rogers and the court's approval for applying 102/103 statutes on product-by-process claims as evident from the excerpt of the MPEP 2113 [R-1] below

[T]he lack of physical description in a product-by-process claim makes determination of the patentability of the claim more difficult, since in spite of the fact that the claim may recite only process limitations, it is the patentability of the product claimed and not of the recited process steps which must be established. We are therefore of the opinion that when the prior art discloses a product which reasonably appears to be either identical with or only slightly different than a product claimed in a product-by-process claim, a rejection based alternatively on either section 102 or section 103 of the statute is eminently fair and acceptable. As a practical matter, the Patent Office is not equipped to manufacture products by the myriad of processes put before it and then obtain prior art products and make physical comparisons therewith. In re Brown, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972).

Claims 23-27 and 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nojiri in view of Rogers as applied to claims 1, 10, and 28 above, and further in view of Vawter et al. (US 6,229,947 B1 Vawter herein forth) and Kawai et al. (US 6,345,138 Kawai herein forth).

Nojiri in view of Rogers teach a light transmitting device having a graded index of refraction comprising alternate layers of a first amorphous material having a thickness and a second amorphous material each layer of material having a thickness substantially less than an effective wavelength of the light. The gradient index is made of the difference of refractive index, at least $\Delta n=0.5$, and the thickness of the layers are gradual.

However, Nojiri and Rogers do not explicitly teach applying the transmitting device as a mode transformer by etching the planar waveguide into rib waveguides.

Kawai teaches transforming a planar wave in the width direction to a spherical wave by tapering the core and provides a graded index by applying plurality of thin films having different indexes of refraction and optically couple the waveguide to an optical fiber (col. 3, lines 40-60).

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Vawter teaches providing grading layers (Fig. 1A) to the mode transformer wherein the tapered rib waveguide mode converter tapered down to a 0.7 micrometer final width (col. 7, line 30).

Since Nojiri, Rogers, Kawai, and Vawter are all from the same field of endeavor, the purpose disclosed by Kawai and Vawter would have been recognized in the pertinent art of Nojiri and Rogers.

Kawai's reference was applied to teach the concept of using a graded index optical element within a mode transformer and Vawter explicitly teaches the mode transformer to contain the parameters that Applicant claimed. Therefore, it would have been obvious to one having ordinary skill in the art to select the desirable combination of material having the desired refractive indices to form a portion in the waveguide having alternating layers of high and low refractive with gradual thickness to form a gradient index region. **The motivation** for forming the gradient index region with in the waveguide of a mode transformer is to transform a planar wave to an elliptical wave.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin D. Chiem whose telephone number is (571) 272-3102. The examiner can normally be reached on Monday - Thursday 9AM - 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Erin D Chiem
Examiner
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